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ROOT TRAINER PLANTING TECHNIQUE FOR *HEVEA*

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Rubber Board India started promoting polybag planting technique during 1980s and at present almost 90% of advanced planting material in rubber is produced in polybags. However, in spite of various advantages polybag plants were noticed to have a few drawbacks also. Taproot of rubber is capable to grow a couple of meters deep in to soil, but the limited length of the polybag prompts it to coil inside at the bottom of the bag. This coiled taproot was noticed to never attain its normal growth even several years after transplanting to the field. Coiling of taproot was also reported to result in root strangling and distortion, subsequently leading to slow growth, poor drought tolerance and lack of wind fastness. The top soil used to fill polybags can limit lateral root formation in polybags. In addition, polybag planting technique is labour intensive and the heavy polybags are quite inconvenient to handle in the nursery, transport to the planting site and transplant to the field. In due consideration of these limitations of polybag plants, root trainer planting technique has widely been used in tree crops in Europe and America from as early as the 1940s. Rubber Research Institute of India standardized root trainer planting technique for rubber as an alternative to the conventional method of polybag planting during late 1990s and accepted it as an official recommendation in 2009.

Fig. 1: Four months old root trainer plant

Specifications for root trainers

The bulky polythene covers used in the polybag planting are replaced with scientifically designed plastic (polypropylene) containers called root trainers. Two types of root trainers are generally used in rubber. Root trainers of height 22 cm having a holding capacity of 600 cc are sufficient for raising advanced planting materials by the technique of *in situ* budding on the sticks raised in root trainers. Slightly larger containers of height 30 cm with a holding capacity of 800 cc are

required for raising advanced planting materials using budded stumps as the initial planting material. The former type of containers have a diameter of 7.0 cm at the top, tapering downwards and end in a drainage hole at the bottom (Fig. 1). The inner wall of the container is provided with several vertical ridges, which end near the drainage hole at the bottom.

Potting medium

Cured coir pith is used as the potting medium. Fresh coir pith contains certain growth inhibiting chemicals like phenol, tannin, chitin etc., which are removed by keeping the coir pith immersed in water for about two months. The coir pith is then half dried and mixed with powdered cow dung in a ratio 4:1 and this mixture is further fortified by adding 250 g each of powdered rock phosphate, powdered neem cake and bone meal per basket which contains 20 kg of the coir pith-cow dung mixture. Appropriate quantities of fungicides (Dithane M-45 @ 5 g per basket) and pesticides (Phorate-10G @ 5 g per basket) are also added and thoroughly mixed with the potting medium.

Filling the containers, planting germinated seeds/budded stumps and stacking

The containers (600 cc) are tightly filled with the potting mixture and germinated seeds are planted. For stump planting, bigger containers of holding capacity 800 cc are filled with potting mixture and budded stumps, preferably green budded, are planted. Care is taken to avoid damaging the skin of the tap root while inserting the stump in to the potting medium. The root trainers are then stacked in trenches in three rows keeping a distance of 15 cm between rows and 5 cm between two plants within the row. A foot path of convenient width is

Fig. 2: Root trainer plants arranged in trenches

maintained between two trenches to facilitate cultural operations. Then topsoil is put in between the containers in such a way that the bottom 1/3 of the containers is covered with soil (Fig. 2). The roots that outgrow the drainage hole are initially permitted to grow in to the soil in the trench.

Irrigation, fertilizer application and after care

Plants are irrigated daily and manuring is done with 2% solution of NPKMg (10:10:4:1.5) at weekly intervals. Water logging in root trainers is cleared immediately on observation and termites are controlled by drenching the containers with 0.1% solution of chlorpyriphos at fortnightly intervals. Shading and disease control measures are adopted as in the case of polybag nursery.

Bud grafting and cut back

The stock seedlings are bud grafted at the age of 30 days (single whorl stage) onwards with bud wood of the same age. The polythene tape is removed 21 days after budding, but cut back at this young stage results in high rate of casualty. So, the plants are retained in the nursery and successful bud grafts are cut back when the stock seedlings attain 4-5 months of growth.

Hardening

The young plants are lifted from the trench when the first whorl of leaves attains maturity. The roots that out grow the containers through the drainage hole are carefully pruned with a knife and the containers are stacked in carriers made of iron rods. The root trainer plants are maintained in this suspended condition for a period of eight weeks (Fig.3). Irrigation, manuring, shading, plant protection etc. are continued. In this suspended condition, off the ground, the

Fig. 3: Root trainer plants stacked in iron stand for hardening

taproot resumes growth within a few days and grows in to the air through the drainage hole at the bottom of the container. On contact with air the taproots cease to grow naturally and thus their coiled growth within the container is prevented. This temporary arrest of growth is generally known as natural air pruning. The natural air pruning of taproot exerts a stress to the plant and the plant responds to the stress by producing large number of additional lateral roots in to the well-aerated potting medium.

Transplanting to the field

The root plug is separated from the container just before transplanting. For this, the root trainer plant is held inverted and the upper brim of the container is tapped against a hard surface, so that the root plug may come out easily without causing any damage to the roots. Then a hole is made in the refilled pit by pressing an empty container onto the soil and the root plug is inserted in to this planting hole. The soil from the sides is pressed towards the plant and all the post-planting operations are adopted as in the case of polybag planting.

Advantages of root trainer planting technique

Air pruning of taproot prevents its coiled growth within the container. Root trainer plants produce large number of lateral roots in to the well-aerated potting medium. The vertical ridges provided in the container wall direct these lateral roots downwards and thus prevent their circular growth within the container. On reaching the drainage hole at the bottom of the container these lateral roots are also subjected to natural air pruning leading to further enhancement of stress which triggers more root production like a vicious circle. As a result, towards the end of this hardening process, the root system of a hardened root trainer plant consists of a central taproot and large number of lateral roots properly oriented within the container (Fig. 4). The air-pruned roots resume growth within 24 hours after transplanting to the field and this quick growth is very helpful to attain 100% establishment success of root trainer plants. The enhanced production of lateral roots influences growth of the plant positively during the juvenile phase.

In addition to improving quality of the planting materials, advanced planting materials raised in root trainers are found to be

cost effective also. Cost of production of a nursery plant is mainly decided by labour charges and the expenditure incurred towards the initial planting material, container, potting medium, fertilizer, pesticides, fungicides etc. Root trainers require approximately 400g of potting mixture as against 8 -10 kg of topsoil required to fill a polybag and hence the labour required for filling, trenching, stacking etc. could be saved correspondingly. Water, fertilizer, pesticides etc. are needed only sparingly in root trainers than in a polybag nursery. Root trainer cups and metallic stands could be reused for several years and hence the initial investment towards these could be realized in a few years. A comparative study made on the cost of production has indicated that advanced planting materials of *Hevea* could be raised in root trainers at 60% of the cost of production of polybag plants once the initial investment is realized. The savings towards transportation, distribution and field planting are the other attractive aspects of root trainer planting technique. Due to the compact size and light weight of root trainer plants, the cost required for transport and distribution could be saved up to 75% compared to polybag plants. The entire process of field planting is so simple and easy that even an unskilled worker could attain several times the turnover compared to polybag planting. Root trainer planting technique is environment friendly, because polybags used in polybag planting are replaced by reusable root trainers and the top soil is substituted by coir pith, which is an industrial waste. This technique is cost effective. Root trainer plants show uniform and fast growth in the field.

Fig. 4: Root plug of a hardened root trainer plant